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SCIENCE

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SCIENCE

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CONTENTS

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THE BOTANICAL OPPORTUNITY[1]

WHEN this program was arranged, it was intended to bring to the attention of botanists how they could serve the nation in the crisis of war. Committees had been multiplied to do various kinds of necessary work. The results were not all that we had hoped for, but botanists were beginning to find themselves, and organization was gradually becoming more effective, because the spirit of cooperation was developing. Enough results were obtained to prove that botany could be of great service at a time of national need. The practical results were not so conspicuous to the public in the immediate activities of the war as those of chemistry and physics for example, but they were fundamental and far-reaching, looking to future as well as to present needs. We must recognize that to bring into effective cooperation great numbers of isolated, scattered, and sometimes conflicting units, takes time and a great controlling motive. But we were making progress, not so rapid as the impatient desired, but probably as rapid as human nature permitted.

Now that the emergencies of war have passed, shall we stop this kind of progress? I wish to attempt to answer this question. In doing so, I shall not formulate any plan, any scheme of organization, but shall present in brief general statement what seems to me to be our opportunity. The other speakers upon the program will doubtless present more concrete suggestions, for which I hope my statement may be an appropriate background.

In connection with the period of reconstruction, there has come to the science of botany a great opportunity, and botanists must rise to the occasion. It is a critical time for our science, for we may lapse into our former state and become submerged by more aggressive

[1] Invitation paper before the joint meeting of botanists at the Baltimore meeting of the American Association for the Advancement of Science.

sciences that will rise to the occasion. This will certainly be our fate unless we make a determined effort. You realize that at the present moment the scientific study of plants is more fully recognized as a great public service than ever before in the history of botany. The recent pressure for food and for a wide range of plant materials and products has been met in the main, not by so-called practical men, but by trained botanists. Not only the practical government service, but also many industries are calling for botanists with fundamental training, realizing as never before that progress is based upon research.

It is the same great opportunity that came first to scientific medicine, through its appeal to the human interest; and later to chemistry in its relation to various industries. It is the appeal of *usefulness,* the appeal that always results in greater opportunity.

A response to this opportunity for public service does not mean *less* science, but *more* science; but it ties up our science so closely to the human interest that it will be in large demand. We are on the rising tide of the greatest demand for trained botanists we have ever known, and it is our task to see to it that the tide does not ebb and leave the profession stranded. If we respond, the opportunities for research will be greater than ever before, as they always are when a science is recognized as of large service. The present endowment for botanical research in universities and in certain industries are as nothing compared with what they will be presently, provided we equip men and women to take advantage of them.

It was my privilege during the war to be present at a meeting of so-called "captains of industry," who were being informed of the contributions that the various sciences could make to the public welfare. The general impression was voiced by one of the auditors in this statement:

> It is obvious that all of our progress in the past has been based on science, and that all our hope of progress in the future must be based on science. It is high time that we begin to pay our debts and give science greater opportunity.

My purpose is to indicate certain things we must stress in ourselves and in our students if we are to rise to the opportunity.

1. *The Synthetic View.*—As we all know, botany has developed many fields of research, and as these fields have multiplied, botanists have become more and more segregated into groups; in fact, in the history of botany we have just been passing through the phase of the *analysis* of our subject. When I began, botany in this country was only taxonomy, and all botanists were interested in the same thing. Then the splitting of the subject began. Different phases gradually became better and better defined, and in consequence more rigid. Presently taxonomists came to know little of any other phase of botany; then morphologists came to know little of taxonomy and to care less; then ecologists and physiologists began to segregate from the rest of us and to narrow their interests, and so for each segregate in turn.

The development of research increased this narrowing process, for it deals with special regions of a general field. For example, in research there came to be as many kinds of morphologists as there are great groups of plants, and so for other fields. This analysis was inevitable and desirable, for it developed technique, the essential equipment for research.

Now, however, the movement is in the other direction. We are passing from the *analysis* of our subject to its *synthesis,* and it is this synthesis that is being called for by the new botanical opportunity. The synthetic view recognizes, not the rigidity of separate fields, but the cooperation of all fields. Every phase of botany must be focused opon our important problems, for we recognize now that every important problem is synthetic. Our superficial separate problems that we have been cultivating have introduced us to the fact that nature is a great synthesis, and must be attacked synthetically. In the days ahead, the botanist who remains narrow will be stranded. We must recognize in every field of botany an important factor in the solution of problems. A man is expected to think

his own field the most important, but if he thinks other fields *un*important, he has blocked his own progress, and is bound to move in ever narrowing circles.

One of the demands upon us, therefore, is to cultivate the synthetic attitude of mind; to develop about our own specialty a penumbra of the botanical perspective. In other words, botanists must cease to be provincial; they must not be citizens merely of one small group, with no larger contacts, but citizens in the world of science. We must not remain persistently in the narrow valley in which our work lies, but we must get on to the mountain top often enough to realize the perspective.

2. *The Practical Outlook.*—The new opportunity demands this; in fact, it was this that created the new opportunity. This means that we are to see to it that botany is recognized as the greatest field for universal service. Medicine holds that position now in public estimation, simply because it ministers to the unfortunate, but they are in the minority. Botanical research underlies an essential ministry to all. Disarticulation of botany from its practical applications has been most unfortunate, and must not be continued. For example, to segregate botany and agriculture as two distinct fields is to damage both; a mistake that our recent experience has emphasized. The result has been that botany has not contributed to agricultural practise as it should; and agricultural practise has not called upon botany as it should. The same is true of the other industries that involve plants. We must recognize that *every* investigation is of possible practical service, and that *every* practise is of possible scientific suggestion. What we have failed to do is to establish the contacts between science and practise, to indicate the possibilities of every advance in knowledge in the way of public service.

This is very far from meaning that every investigation should have an obvious practical application. Research must be absolutely free, stimulated only by its own interest in advancing knowledge, but the importance of fundamental knowledge in solving practical problems should be emphasized at every opportunity.

Our recent experience in connection with emergency problems has shown that no field of botanical investigation is so remote from practical needs that it can not make its contribution if necessary. For example, taxonomy was called upon for information as to new geographical sources and new plant sources for raw products; vascular anatomy was asked to contribute its experience in solving some very important timber problems; ecologists were urged to organize their knowledge so as to be serviceable in relating the suitable crops to soil and climate; physiologists were constantly contributing information as to the possible control of processes essential to plant production. Pathologists did not need so much to demonstrate their usefulness, for their results are obviously practical, and for this very reason it is easier to secure opportunities for research in pathology than for any other of these fields of research. It is not a question of becoming *practical,* but merely of establishing connections that are obvious to the investigator.

We must emphasize, therefore, the connection between what have been called pure science and applied science, which have too long been pigeon-holed into separate compartments. Upon a previous occasion I have emphasized this relationship as follows:

> All science is one. Pure science is often immensely practical, applied science is often very pure science, and between the two there is no dividing line. They are like the end members of a long and intergrading series; very distinct in their isolated and extreme expression, but completely connected. If distinction must be expressed in terms where no sharp distinction exists, it may be expressed by the terms "fundamental" and "superficial." They are terms of comparison and admit of every intergrade. In general, a university devoted to research should be interested in the fundamental things, the larger truths that increase the general prospective of knowledge, and may underlie the possibilities of material progress in many directions. On the other hand, the immediate material needs of the community are to

be met by the superficial things of science, the external touch of the more fundamental things. The series may move in either direction, but its end members must always hold the same relative positions. The first stimulus may be our need, and a superficial science meets it, but in so doing it may put us on the trial that leads to the fundamental things of science. On the other hand, the fundamentals may be gripped first, and only later find some superficial expression. The series is often attacked first in some intermediate region, and probably most of the research in pure science may be so placed; that is, it is relatively fundamental, but it is also relatively superficial. The real progress of science is away from the superficial toward the fundamental; and the more fundamental are the results, the more extensive may be their superficial expression.

It is this situation that we must drill into our students, into ourselves, and into the community.

3. *Cooperation in Research*.—One of the most important by-products of the war has been the proof that if a nation is to develop its maximum strength and efficiency, all of its citizens must join hands and work together; in other words, competition must give place to cooperation. What is true of a nation is true of a science. Our isolated, more or less competitive investgations have resulted in a certain amount of progress; but it has been very slow compared with what cooperation would have secured. The important problems to-day are either too complex for the training of any one investigator, or they call for too many data for one investigator to secure, at least in a reasonable time. In the first case the problem is attacked sporadically from one aspect and then another, the attacks entirely unrelated to one another, and the result is a débris of unorganized results that is more apt to leave the subject in confusion than to clarify it. In the second case the data are either insufficient or are accumulated by an indefinite succession of investigators, probably under fluctuating conditions. As a result, both time and accuracy are sacrificed. Intelligent cooperation would clear up both of these situations and in a comparatively short time reach results that are fairly clear and accurate. Of course, effective cooperation is not possible unless it is voluntary.

This suggests what is probably the most serious obstacle to any general adoption of the cooperative method. We have worked so long in our isolated way in a kind of monastic seclusion, that we have come to regard our problems as personal property, and feel a sort of resentment if any other investigator ventures within our territory. This means that, perhaps unconsciously, we are more concerned with our own personal credit than with the solution of the problem. If our old method has developed this attitude of mind among investigators, it is high time to change it and to realize that research is to advance knowledge, and is not for self-glorification. What the science wants, and what the world wants, is *results,* as quickly and accurately as possible. If we can not be large enough to put truth above ourselves, the outlook for botany is discouraging.

The spirit of competition between individuals is depressing enough, but when it extends to competition between research establishments it is worse. This spirit of aloofness is the more emphasized between institutions that deal primarily with practical questions and those that deal primarily with fundamental research. For example, why should not the investigators of our universities be called upon freely by the Department of Agriculture for the help their training can give; and why should not the university investigators draw freely upon the immense store of practical experience that the Department of Agriculture has collected? Neither set of establishments can do all that is necessary. If each remains in relative isolation, absorbed by its own self-confidence, both science and practise will suffer. Such artificial barriers of self-sufficiency to full cooperation should be broken down that our science and its applications may be free to develop normally. To speak physiologically, we must remove the inhibitions, personal and institutional, and give the stimuli a chance.

In conclusion, if I may venture a prophecy, it would be that if in response to the great

opportunity that has come to us, we shall pledge ourselves to be synthetic rather than narrow in our point of view, to emphasize the possible practical connections of botanical problems, and to submerge our personal and institutional temperaments in a spirit of general cooperation to secure results, botany will come to be recognized as a great national asset, and research will enter upon a new era.

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PSYCHIATRY AND THE WAR

THE influence of the war upon psychiatry in Great Britain has been profound and shows itself in many different directions. A most important effect has been to draw psychiatry into closer relations with neurology. As an indirect result of the stringency of the lunacy laws there had come into existence in Great Britain a state unknown in other countries, in which a deep gulf existed between those who deal with the insane and those who treat the neuroses, the latter affections usually coming under the care of physicians otherwise occupied with the treatment of organic nervous disease. This gulf has been largely bridged as a result of the war. Both groups of practitioners have been called upon to deal with the enormous mass of psycho-neurosis which the war has produced, with the result that the outlook of each has been greatly widened.

One, and perhaps the most important outcome of this combined activity has been the general recognition of the essential part taken in the production and maintenance of the psycho-neuroses by purely mental factors. In the early stages of the war especial stress was laid on the physical effects of shell explosion, an attitude which found expression in the term shell-shock. As the war has progressed the physical conception of war-neurosis has been gradually replaced by one according to which the vast majority of cases depend on a process of causation in which the factors are essentially mental. The shell explosion or other catastrophe of war, which forms in so many cases the immediate antecedent of the illness, is only the spark which releases deep-seated psychical forces due to the strains of warfare. It has also become clear how large a part is taken in the causation of neurosis by physical factors which only come into action after the soldier has been removed from the scene of warfare.

Not only has war-experience shown the importance of purely mental factors in the production of neurosis, but it has also shown the special potency of certain kinds of mental process, the closely related emotional and instinctive aspects. This knowledge is already having, and will have still more, profound effects upon the science of psychology. This science has hitherto dealt mainly with the intellectual side of mental life and has paid far too little attention to the emotions. Students of certain aspects of mind, and especially those engaged in the study of social psychology, were coming to see how greatly psychologists had over-estimated the intellectual factor. The results of warfare have now compelled psychiatrists to consider from the medical point of view the conflicts between the instinctive tendencies of the individual and the forces of social tradition which workers in other fields have come to recognize as so potent for good and evil in the lives of mankind.

Closely related to this movement is another which has led those dealing with the psycho-neuroses to recognize far more widely than hitherto the importance of mental experience which is not directly accessible to consciousness. Warfare has provided us with numberless examples of the processes of dissociation and suppression by means of which certain bodies of experience become shut off from the general mass making up the normal personality, but yet continue to exist in an active state, producing effects of the most striking kind, both mental and physical.

An interesting by-product of this increased attention to the instinctive, emotional and unconscious aspects of mind has been a great alteration in the attitude of psychiatrists to-

wards the views of the psychoanalytic school. Before the war many psychologists were coming to see the importance of Freud's work to their science, but within the medical profession, the general attitude was one of uncompromising hostility. This state of affairs has been wholly altered by the war. The partisans of Freud have been led by experience of the war-neurosis to see that sex is not the sole factor in the production of psycho-neurosis, but that conflict arising out of the activity of other instincts, and especially that of self-preservation, takes an active if not the leading rôle. On the other hand, independent students who, partly through lack of opportunity, had not previously committed themselves to either side, have been forced by the facts to see to how great an extent the nature of the psycho-neuroses of warfare support the views of Freud and have made it their business to sift the grain from the chaff and distinguish between the essential and the accidental in his scheme. To such an extent has the reconciliation gone that it has recently been possible for the chief adherent of Freud to read a communication before the leading medical society of London without exciting any trace of acrimony and only such opposition as must be expected when dealing with a subject as new and complex as that under discussion. There are many signs that the end of the war will find psychiatrists and psychologists ready to consider dispassionately the value of Freud's scheme as a basis for the study of the psychoses as well as of the psycho-neuroses of civil life, ready to accept the good and reject the false without the ignorant prejudice and bitter rancor which characterized every discussion of the subject before the war.

Concurrently with the general recognition of the essentially psychical of neurosis, there has taken place a great development on the therapeutical side. As a result of the war psycho-therapy has taken its place among the resources of the physician. There is still far from general agreement concerning the value of different forms of psycho-therapeutic treatment, but work is steadily going on in testing the value of different methods. In the early stages of the war extensive use was made of hypnotism and hypnoidal suggestion, and owing to the striking character of its immediate results this mode of treatment still has a considerable vogue. The general trend of opinion, however, has been against its employment as tending to undermine the strength of character which is needed to enable the victim of neurosis to combat the forces which have temporarily overcome him. Many of those who used hypnotism largely in the early days of the war have given it up in favor of other less rapid and dramatic but more efficacious modes of treatment.

The treatment which has had most success consists of a form of mental analysis which resembles to some extent the psycho-analysis of Freud, but differs from it in making little attempt to go deeply into the unconscious, except in so far as any dissociation present has been the result of recent shocks of warfare. Attention is paid especially to those parts of experience which without any special resistance become accessible to the memory of the patient, and to seek by means of the knowledge so acquired to demonstrate to the patient the essentially psychical nature of his malady. By a process of reeducation he is then led to adjust himself to the conditions created by his illness.

The knowledge already gained, and still more that which will become accessible when those at present fully occupied with the needs of the moment have leisure to record their experience, will be of the utmost importance to the future of psychiatry. Already before the war a movement was on foot to bring about reforms in the treatment of mental disorder, the measures especially favored being the establishment of psychiatric clinics and the removal of curable and slight examples of psychosis from association with more chronic cases. This movement will be greatly assisted by the knowledge and experience gained during the war. Those in the medical profession who are moving towards reform will gain a large body of support from many members of the laity who have come through

the war to recognize the gravity of the problem. A large body of exact knowledge will be available to assist those whose business it will be to set the care and treatment of mental disorder on a new footing. Psychiatry will emerge from the war in a state very different from that it occupied in 1914. Above all it will be surrounded by an atmosphere of hope and promise for the future treatment of the greatest of human ills.

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INTELLECTUAL INTERCOURSE BETWEEN ALLIED AND FRIENDLY COUNTRIES

IN the beginning of 1917, there was founded in Italy, with its seat at the University of Rome, a society having the title: *Associazione italiana per l'intesa intellettuale fra i pæsi alleati ed amici* (Italian society for intellectual intercourse between allied and friendly countries). Its president is Senator V. Volterra, and the names best known in the literature and science of Italy are represented on the committee which directs its work.

The name of the society is self explanatory—in the publication of a quarterly review, entitled *L'intesa intellettuale,* its work has already begun in a definite way. The purpose of the review, which is the same as that of the society, may be explained as follows: (1) More active and frequent intercourse between universities, academies of science, and, in general, educational institutions of the allied and friendly countries; (2) increased teaching of the Italian language in foreign countries, with greater extension in Italy of the teaching of the languages of allied and friendly countries; (3) exchange of teachers of every order and rank; (4) reciprocal acknowledgment of the requirements for admission to the universities and courses of lectures; (5) exchange of students either for special study or to acquire general knowledge of the different countries; (6) to facilitate the exchange of publications and books and to increase knowledge of Italian works; (7) to make known by translation the best Italian works; (8) cooperation in the field of science and its practical applications, and especially in the law in regard to questions of private law; (9) intellectual relations of every kind between people who wish to render more close, durable and fruitful the union of the nations which fought the battles of civilization together.

Some of these purposes coincide with those stated in the outline of the plan for an interallied research council proposed by Dr. G. E. Hale. In the National Research Council, founded by him at the beginning of the present war, Dr. Hale planned a constant interchange of methods and results which would secure the complete cooperation of the Allies and the United States, and provide means of reaching common agreement between them in regard to the immediate necessities of the war, and now for the more fruitful works of peace.

Probably in no country other than Italy are to be found so many foreign institutions for research in science, literature, history and the arts. These are of course means of cooperation and exchange, but the exchange is now only on one side owing to the lack of similar organizations for Italian people in foreign countries. The principal difficulty in cooperating with us is certainly that of language; and there is no doubt that the English and Italian speaking peoples should become more familiar with each other's language in order to acquaint themselves better with Italian and English works.

As exchange of teachers and students is one of the best methods of overcoming this particular difficulty, in July, 1917, our Ministry of Public Instruction elected a committee with Senator V. Volterra as its president to study and draft a law regulating the exchange of teachers and the interscholastic relations of Italy with foreign countries. Early in 1918 the committee presented its plan, in a report which gives its fundamental conceptions and principal arrangements. These are given in the first article of the first issue of *L'intesa intellettuale* and are here summarized.

According to its program the committee proposes that an independent office be instituted in the Ministry of Public Instruction to promote and direct the exchange of teachers with foreign countries, to send abroad Italian men of letters for historical or scientific research or to teach, to summon foreign teachers or students to Italy, to regulate fellowships, to provide eventually for the foundation of Italian institutions of higher education outside the boundaries of Italy, and to cultivate in every way our intellectual relations with other nations.

The office will consist of a council and an executive board, with the Minister of Public Instruction as president of both. In the council, composed of twenty-one members, the faculties of the universities, the Minister of Public Instruction with the two general directors of higher and secondary instruction, the Ministry of Foreign Affairs, that of Agriculture, of Industry and Commerce, and the Congress are all duly represented. As the Ministry of Public Instruction is given power to elect two members at large, elements outside the school and state administration may also have representation.

With full autonomy in its deliberations and in the administration of funds which must be assigned by the departments concerned, the office has that freedom necessary to accomplish its varied and delicate functions.

The council issues every year a general program of the various activities of the office, but the really active body is the executive board composed of seven members elected by the council from its own members.

The law which has already been mentioned gives rules for those going to foreign countries to teach or to study, providing for their legal status and for that of foreign professors who come temporarily to Italy for the purpose of teaching. The Italian professors who, by the arrangement of the office and with the approval of the proper ministry, go to foreign countries, are divided into three classes according to the length of time they are to be absent from the kingdom: for less than one year, for more than one year and less than five, or for more than five years. On the foreign professor who teaches in Italy is conferred the dignity of the Italian professor of equal rank, and legal validity is given to his course of lectures, under certain conditions.

The last part of these regulations determines the legal value of studies pursued outside the kingdom, of study of foreigners in Italy, and of the fellowships. In general, studies and examinations taken in state institutions or those of equal rank in foreign countries are accepted as of the same value as studies and examinations taken in schools of the same rank in Italy. The fellowships are not restricted, as hitherto, to graduates, but may also be awarded to university students who desire, for the sake of some special work, to visit laboratories, libraries, or foreign archives. Every year a certain number of fellowships is offered to students and graduates (provided they are of not more than two years standing) of high schools, normal and professional schools, and special institutions, in order to make it possible for them to follow courses of study in foreign countries. Among the advantages of such a plan, by no means the least important will be the preparation of good teachers of foreign languages.

The outline given here offers nothing more that the general plans of an extended program. The law itself will constitute the basis for proposed international conventions to facilitate and promote our intellectual relations with foreign countries, and to extend knowledge of Italy beyond our boundaries on the one hand and, on the other, to gain information about the friendly countries.

To give rapid development to this plan and to cooperate with the state institutions in Italy and abroad for its accomplishment is of course one of the most important tasks of the Italian Association. Probably similar associations in the allied and friendly countries will be able to cooperate with it for this purpose.

The other articles of the first two issues of *L'intesa intellettuale* which reached this country deal with the organization of the

schools and educational institutions in Italy and abroad. These articles are by Piero Giacosa, on the "Institutes of Experimental Sciences" (physics and chemistry); by Pietro Bonfante, on the "New Scientific Degrees"; by Eugénie Strong, on the "Britannic School in Rome"; by Alfredo Ascoli, on a "Legislative Alliance"; by Andrea Galante, on the "English Education Bill of 1917"; by L. Duchesne, on the "Transformation of the University Teaching in France"; by V. Scialoja, on the "Giuridic Entente between France and Italy"; by P. S. Leicht, on the "College of Spain and Flanders in Bologna," and by G. Castelnuovo, on the "Reform of the Engineering Schools in France."

We should soon like to see some articles on the educational institutions and research laboratories of the United States and to learn of their vast development and progress along these lines. We would recommend that American scholars write these articles and in them present also their suggestions for the most interesting studies and fields for research in science, literature and law, and indicate the schools, colleges and laboratories that might most profitably be visited by Italian colleagues and students, in order to begin this intercourse and cooperation from which many advantages are to be expected.

GIORGIO ABETTI

WASHINGTON, D. C.

GEORGE FRANCIS ATKINSON

IN the death of George Francis Atkinson American botany has suffered an incalculable loss. Stricken unexpectedly he died at the beginning of what promised to be his most productive period of activity. Having served for more than a quarter of a century as professor of botany in Cornell University he had only recently been relieved by the trustees of all teaching and administrative duties in order that he might give the remaining years of his life to uninterrupted research. He hoped particularly to be able to complete and put in final form for publication his monographic studies on the fleshy fungi of North America. In the pursuit of this undertaking he had gone without assistants for an extended collecting trip to the far west. Here with characteristic enthusiasm for his work and lured by the surpassing richness of the fungous flora near Mt. Ranier he overtaxed his strength, exposed himself to inclement weather, and contracted a severe cold. This rapidly developed into influenza followed by pneumonia, and he died on November 15, in the Tacoma Hospital at Tacoma, Washington. His end came suddenly and found him alone far from friends and home. After his removal to the hospital, though critically ill, his chief worry concerned the recently collected specimens which he had been forced to leave uncared for in the room of his boarding house. Shortly before he died, in his last delirium, he attempted to dictate to his nurse some notes concerning his fungi. Thus death found him engrossed to the very end in the science which he had so long served and which he loved so well. He lies buried at South Haven, Mich., near the home of his boyhood. Ithaca and Cornell will not see him again. To his friends and colleagues it is a thing incredible that his genial personality and brilliant mind are gone from among us. The words, "Professor Atkinson is dead" have passed from lip to lip and left us almost unconvinced. The memory of him and his work now so clearly before us will serve as a guiding influence through the coming years. It is particularly gratifying to the writer to be able to give here an expression of his appreciation of one whom he revered as a great teacher and valued as a true friend.

Professor Atkinson was born in Raisinville, Monroe County, Michigan, January 26, 1854. He received his preliminary academic training at Olivet College, coming later to Cornell University, from which he was graduated in 1885. The following year he began his scientific career as professor of zoology at the University of North Carolina, and between the years 1886 and 1890 published about fifteen papers in the field of zoology. In 1888 he accepted the professorship of botany and

zoology in the University of South Carolina, and in 1889 became professor of biology and botany in the Alabama Polytechnic Institute. While at the latter institution he published as a bulletin of the Alabama Agricultural Experiment Station perhaps his best known zoological paper on the root-gall nematode, *Heterodera radicicola*. His interests shifted rapidly, however, to the fields of plant pathology and mycology, and in 1892 he returned to his alma mater to accept the position of assistant professor of botany. He became associate profesor in 1893, and at the death of Professor Prentiss in 1896 became head of the department.

During the last twenty-five years of his life, though burdened with the multitudinous duties of teaching and administration, he found time to devote himself to research in various fields of botany. He labored untiringly and published over one hundred and fifty papers concerning his investigations. These reveal an unusually wide range of interests. He was also the author of extensively used text books including, "The Biology of Ferns," "Elementary Botany," "A College Text Book of Botany" and "Mushrooms Edible, Poisonous, etc." He rapidly attained an eminent position among the botanists of the world, and received many honors. He was the first president of the Ameican Botanical Society, and throughout his life took an active part in numerous other scientific organizations. His high standing as a scientist was given formal recognition when in 1918 he was elected a member of the National Academy of Science. He served as a delegate to the International Botanical Congresses of 1905 and 1910 held in Vienna and Brussels respectively, and at these meetings used his influence to obtain legislation making for greater stability and uniformity in botanical nomenclature. He traveled in various countries of Europe studying in the field the fleshy fungi of the different regions, and making the acquaintance of an extensive circle of his European colleagues. He was widely known in other lands as a prominent American student of the fungi.

Although his interests covered many fields of botany his highest attainments were realized in mycology. He was undoubtedly one of the foremost students of the fleshy Basidiomycetes which America has produced. Through years of enthusiastic collecting and study he had acquired a herbarium of specimens and a wealth of photographs and notes which gave him a thoroughly comprehensive grasp of this field. Had he lived to complete the extensive illustrated monograph of this group which he had in process of preparation it would have far surpassed in thoroughness and scope any similar paper on these fungi which has yet appeared in any language. His inability to do so will always remain a source of great regret to his students, and constitutes a very distinct loss to the science of mycology.

In the field of general mycology Professor Atkinson was especially interested in questions of phylogeny. Any newly discovered fungus which promised to supply a transition form from one group to another gained his immediate interest. This interest in phylogeny found expression in his comprehensive papers on the origin of the Phycomycetes and Ascomycetes, and is also reflected in the numerous papers which he and his students published on the ontogeny of the fruit-body in many members of the Agaricaceæ and related groups. The unusual keenness of his reasoning powers and the richness of the fund of knowledge from which he drew his conclusions are revealed in some of the philosophical discussions in these papers. His marvelously retentive memory was at once the admiration and the despair of his students.

He was a man of firm convictions, resolute in setting for himself the highest standards of scientific excellence, and impatient of mediocrity in others. His untiring devotion to his work will long remain an inspiration to those whose fortune it was to know him intimately as teacher or friend. HARRY M. FITZPATRICK

SCIENTIFIC EVENTS

THE GERMS OF INFLUENZA AND YELLOW FEVER[1]

MAJOR H. GRAEME GIBSON, R. A. M. C., who died recently at Abbéville, was a martyr to

[1] From the London *Times*.

science and almost at the hour when, in company with two other workers, Major Bowman, Canadian Army Medical Corps and Captain Conner, Australian Army Medical Corps, he had completed the discovery of what is very probably indeed the causative germ of this influenza epidemic.

A preliminary note regarding this germ was published by these doctors on December 14, 1918, in the *British Medical Journal,* and thus Major Graeme Gibson's work takes precedence over later publications. At the time, however, the proof of the discovery was not complete. It has now been completed, as we understand; and Major Gibson's death furnishes a part of the evidence. His eagerness and enthusiasm led him to work so hard that he finally fell a victim to the very virulent strains of the germ with which he was experimenting. He himself caught the influenza, and pneumonia followed.

The germ belongs to the order of filter-passers and is grown by the Noguchi method. It is reported that monkeys have been infected with it quite easily, and have developed attacks producing small hemorrhages in the lungs a soil quite suitable for the reception of the pneumococcus. The chain of evidence thus seems to be very strong. Further, we understand that the germ closely resembles that described by Captain Wilson in the *British Medical Journal* a few weeks ago. Thus Captain Wilson's work seems to confirm the work of Major Graeme Gibson and his colleagues.

It is interesting to note that this work, which has had such fatal consequences for one of the party, has been conducted by three Army doctors, a member of the British forces, a member of the Canadian, and a member of the Australian. The directors of the Medical Service in France deserve the greatest credit, we learn, for the splendid support they have given these workers, while the Medical Research Committee, working with the Army authorities, has rendered invaluable help.

Attention has been so firmly fixed in these last months upon influenza that an interesting event in the medical world has more or less escaped attention. This is the description by Professor Noguchi of a new germ in connection with yellow fever.

That disease has for long furnished a subject of discussion, because doubt existed as to its exact causation. Dr. Noguchi states that the organism discovered by him belongs to the class known as spirochetes, of which the spirochete of syphilis and that of relapsing fever are other members.

If the discovery is confirmed it will add another link to the wonderful chain of discoveries forged in connection with this disease. The fever was first described in Barbados in 1647. Its dreadful virulence soon earned it its evil reputation, and this virulence became a matter of world-wide concern when in the so-called "great period" of the fever it visited Cadiz in five epidemics, Malaga, Lisbon, Seville, Barcelona, Palma, Gibraltar and other European towns. At Lisbon in 1857 some 6,000 persons died in a few weeks.

The fever remained a mystery up till about 1881, when Dr. Charles Finlay, of Havana, propounded the idea that mosquitoes carried the infection. The view found small support at first, but later Ross's work on malaria reawakened interest in it. Then came the Spanish-American war and the appointment of a commission by the American government to investigate Finley's theory. The workers nominated were Walter Reed, James Carroll, A. Agramonte, and Lazear. They began by collecting the suspected mosquitoes, allowing them to feed on yellow fever patients, and then submitting themselves to the bites. Their labors were crowned with immediate success, though lives of great value were heroically sacrificed. It was proved that the mosquito *Stegomyia fasciata* is the agent of infection, that the virus of the disease is present in the blood during the first days of infection, and that "the germ is so small that it can pass through a Chamberland filter." Infection could not be produced till after several days from the time when the mosquito had bitten the yellow fever patient, so that it was evident that the germ underwent some change in the body of its insect host.

This work furnished the material of the wonderful campaign by which Gorgas cleansed the Panama Canal zone of yellow fever, and so made possible the completion of that work. Gorgas came to Panama from Havana, which he had also cleansed of yellow fever in about a year, though the place was a famous hot-bed of the disease. His method was to attack the mosquito in its breeding places and to exclude it as far as possible from contact with fever cases.

Dr. Noguchi's work on filter-passing germs is well known. It is also well known that from time to time the suggestion has been offered that the spirochetes pass through two stages of development, one of these stages being of an extremely minute type. Whether or not this view will receive confirmation through the new discovery remains to be seen. In all matters bacteriological it is necessary to keep an open mind until proof of an absolute kind has been forthcoming.

LECTURES BY PROFESSOR BLARINGHEM

DR. LOUIS BLARINGHEM, professor of agricultural biology at the Sorbonne, and exchange professor at Harvard University for 1918–19, is giving a series of ten lectures in French, beginning on Tuesday, April 15, on "The condition and future of agriculture in France." The lectures will be given in Emerson Hall, on Tuesday and Friday afternoons at 4.30 o'clock. They will be open to the public. The dates and titles are as follows:

Avril 15. Le sol français; variétés des terrains et climats. Crûs.

Avril 18. Grandes cultures: blé, betteraves, pommes de terre, lin.

Avril 22. Prés et bois; amélioration des pâturages; plantation des dunes et des territoires dévastés.

Avril 25. Arbres fruitiers; vignes; volailles. Qualités et débouchés.

Avril 29. Cultures forcées; serres et abris vitrés. Production des fleurs.

Mai 6. La science française et l'agriculture. Engrais chimiques.

Mai 9. La lutte contre les maladies du bétail et des produits fermentés.

Mai 13. La production de nouvelles variétés par des sociétés industrielles.

Mai 16. Le paysan français producteur de crûs. Son éducation, ses aptitudes et ses besoins. Rôle de la fermière.

Mai 20. Avenir et renaissance de l'agriculture française. Emploi des machines. Développement des moyens de transport.

NATIONAL RESEARCH COUNCIL

MEMBERS of the Division of Chemistry and Chemical Technology have been nominated as follows:

By the *American Chemical Society:* C. L. Alsberg, Bureau of Chemistry, Department of Agriculture, Washington, D. C.; W. D. Bancroft, National Research Council, Washington, D. C.; C. G. Derick, National Aniline & Chemical Co., Inc., Buffalo, N. Y.; J. M. Francis, Parke Davis & Co., Detroit, Mich.; E. C. Franklin, Leland Stanford Jr. University, Stanford University, Cal.; W. F. Hillebrand, Bureau of Standards, Washington, D. C.; John Johnston, Yale University, New Haven, Conn.; Julius Stieglitz, University of Chicago, Chicago, Ill.; J. E. Teeple, 50 East 41st St., New York, N. Y.

By the *American Electrochemical Society:* Colin G. Fink, 20 2nd St. and 10th Ave., New York, N. Y.

By the *American Institute of Chemical Engineers:* Hugh K. Moore, Research Laboratory, Brown Co., Berlin, N. H.

By the *American Ceramic Society:* Albert V. Bleininger, Bureau of Standards, Pittsburgh, Pa.

By the *Division:* C. H. Herty, 35 East 41st St., New York, N. Y.; G. A. Hulett, Princeton University, Princeton, N. J.; A. B. Lamb, Harvard University, Cambridge, Mass.; A. A. Noyes, Massachusetts Institute of Technology, Cambridge, Mass.; C. L. Parsons, Bureau of Mines, Washington, D. C.; E. W. Washburn, University of Illinois, Urbana, Ill.

THE AMERICAN SOCIETY OF MAMMALOGISTS

THE American Society of Mammalogists held its organization meeting in the New National Museum, Washington, D. C., April 3 and 4, 1919, with a charter membership of over two hundred and fifty, of whom sixty were in attendance at the meeting. The following officers were elected: C. Hart Merriam, president; E. W. Nelson, first vice-president; Wilfred H. Osgood, second vice-president; H. H. Lane, recording secretary; Hartley H. T. Jackson, corresponding secretary, and Walter P. Taylor,

treasurer. The councilors are: Glover M. Allen, R. M. Anderson, J. Grinnell, M. W. Lyon, W. D. Matthew, John C. Merriam, Gerrit S. Miller, Jr., T. S. Palmer, Edward A. Preble, Witmer Stone and N. Hollister, editor.

Committees were appointed on: Life histories of mammals, C. C. Adams, chairman; Study of game mammals, Charles Sheldon, chairman; Anatomy and phylogeny, W. K. Gregory, chairman; and Bibliography, T. S. Palmer, chairman. The policy of the society will be to devote its attention to the study of mammals in a broad way, including life histories, habits, relations to plants and animals, evolution, paleontology, anatomy and other phases.

Publication of the *Journal of Mammalogy*, in which popular as well as technical matter will be presented, will start this year.

Any person interested in mammals is invited to become a member of the society, and those who qualify before the next annual meeting will be considered charter members. Every one who desires to have a complete file of the journal should join now. Annual dues are three dollars; life membership seventy-five dollars in one payment.

SCIENTIFIC NOTES AND NEWS

IN connection with the semi-centennial celebration of Cornell University a dinner will be given on June 19 by the department of physics and members of the university faculty to Professor E. L. Nichols, who retires from the active work of the professorship of physics.

PROFESSOR JACQUES HADAMARD, of the Collège de France, has accepted an invitation from Yale University to be a Silliman Lecturer in the spring of 1920. M. Hadamard is a distinguished French mathematician who received the honorary degree of LL.D. at the Yale Bicentennial in 1901.

C. TATE REGAN has been appointed assistant keeper of zoology in the British Natural History Museum in succession to Mr. W. R. Ogilvie Grant, who has retired.

PROFESSOR M. I. PUPIN, of Columbia University, until recently Royal Consul General for Serbia to the United States, has gone to France to the Peace Conference.

DR. C. HART MERRIAM has been elected chairman of the U. S. Geographic Board, as successor to the late Andrew Braid.

EIGHTY trees will be planted in the Caledonia Furnace forest reserve on Arbor Day, honoring Dr. J. T. Rothrock, of West Chester, father of the forestry activities of the state of Pennsylvania, who was eighty years old on April 9.

DR. HENRY ALLAN GLEASON, assistant professor of botany and also director of the Botanical Garden and arboretum at the University of Michigan, has been appointed the first assistant of the director-in-chief of the New York Botanical Garden, succeeding Dr. W. A. Murrill, who has been transferred to the new position of supervisor of public instruction.

THE Hemenway fellowship in the Peabody Museum of Harvard University has been awarded for the year 1918–1919 to Eduardo Noguera, assistant director of antiquities in the National Museum of Mexico, and last year a Robert C. Winthrop scholar at Harvard. The Charles Eliot Ware Memorial Fellowship in the medical school for the academic year 1918–1919 has been awarded to Edward Allen Boyden, of Newton Centre.

DR. ALEXANDER C. ABBOTT, of the University of Pennsylvania, has been promoted to the rank of colonel. He is now in charge of the sanitary supervision of the territory occupied by the second Army, but expects to be back at the university in the fall.

CAPTAIN ELTON D. WALKER, head of the department of civil engineering of Pennsylvania State College, has returned after more than eighteen months' service overseas.

CAPTAIN H. C. PORTER, of the Ordnance Department, U. S. A., is now with the Chemical Service Laboratories, at West Conshohocken, Pennsylvania.

CAPTAIN R. R. RENSHAW, C.W. S., who has been directing a corps of research men in the Johns Hopkins University war laboratory,

will remain at the university for special research work in organic chemistry. Captain Renshaw is professor of chemistry at Iowa State Agricultural College on leave of absence.

Dr. J. Edwin Sweet, professor of surgical research in the medical school of the University of Pennsylvania, has been promoted from major to lieutenant colonel. Colonel Sweet went to France with Base Hospital No. 10.

Lieutenant-Colonel Nelson Miles Black, M. C., U. S. Army, has been designated as officer in charge of the section of head surgery, Surgeon-General's Office, vice Colonel Walter R. Parker.

Lieutenant-Colonel E. G. Zabriskie, of New York City, has been designated senior consultant in neuropsychiatry for the American Expeditionary Forces, succeeding Colonel Thomas W. Salmon, who has returned to the United States for duty in the Surgeon-General's Office. Lieutenant-Colonel Zabriskie went to France as divisional neuropsychiatrist of the fourth division. Subsequently he was consultant in neuropsychiatry to the third and fifth corps and the first army. After the armistice he served as consulting neuropsychiatrist to the Savenay hospital center.

Captain S. T. Dana has resigned from the Army and has resumed his duties with the Forest Service as assistant chief of forest investigations. Captain Dana was on the general staff as secretary of the army commodity committee on lumber, and in charge of determining wood requirements of the army.

Dr. A. L. Walters, lately of the Army Medical Corps, has resumed his old duties as director of the department of experimental medicine, Eli Lilly and Co., Indianapolis.

Dr. Hugh S. Taylor has returned to Princeton University to take up his duties again after service with the British government in the Munitions Invention Department, where he has been engaged on problems connected with the preparation and purification of hydrogen.

Mr. John D. Northrop, of the Geological Survey, has accepted a position with an oil company at Cheyenne, Wyoming.

Mr. E. W. Guernsey, formerly with the Chemical Warfare Service, is now at the research laboratories of the Brown Company, at Berlin, N. H.

Assistant Geologist David B. Reger, of the West Virginia Geological Survey, will spend the next three months in Tucker County, West Virginia, making detailed researches for a county geological report. Local headquarters will be at Parsons, West Virginia.

At an international conference in London, on March 11 to 15, William A. Lippincott, professor of poultry husbandry in the Kansas State Agricultural College, was elected secretary of the International Association of Poultry Instructors and Investigators. He succeeds Dr. Raymond Pearl, of the Johns Hopkins University, who recently resigned.

Professor W. T. Sedgwick, of the Massachusetts Institute of Technology and the Harvard-Technology School of Public Health, will leave Boston on May 1 for California, where he is to give instruction in "Sanitary Science and Public Health Problems" during the summer session of the University at Berkeley. Professor Sedgwick recently has been elected to membership in the International Health Board of the Rockefeller Foundation and also has been appointed directing sanitary engineer, with the grade of assistant surgeon general, in the Reserve of the United States Public Health Service.

At the twenty-ninth annual meeting of the Association of American Medical Colleges, held in Chicago, on March 4, the following officers were elected for the ensuing year: president, Dr. George Blumer, New Haven, Conn.; vice-president, Dr. A. C. Eycleshymer, Chicago; secretary-treasurer, Dr. Fred. C. Zapffe, 3431 Lexington Street. Chicago; chairman of executive council, Dr. Irving S. Cutter, Omaha. An entirely new constitution and by-laws were adopted, the principal differences from the old set of rules being in the requirements, high-school and college premedical, for admission to medical schools. The requirement in physics was reduced to six semester

hours, and in biology it was decided that six semester hours of college work were acceptable for students who had completed a year of biology in high school.

DR. W. W. ROWLEE, of Cornell University, gave an illustrated lecture on "Balsa Wood, its production and uses," at the New York State College of Forestry at Syracuse, on April 2. The lecture included scientific data and experiences gleaned from an eight month's absence in Central America in the employ of the American Balsa Company.

DR. JOHN C. MCVAIL delivered the Milroy Lectures before the Royal College of Physicians of London on March 13, 18 and 20; his subject being half a century of smallpox and vaccination. The Goulstonian Lectures, on the spread of bacterial infection was delivered on March 25, 27 and April 1, by Dr. W. W. C. Topley, lecturer on bacteriology Charing Cross Medical School and the Lumleian Lectures, by Sir Humphry D. Rolleston, on cerebro-spinal fever, were planned for April 3, 8 and 10.

JOHN E. JOHNSON, JR., a director of the American Institute of Mining and Metallurgical Engineers, died on April 4 in Scarsdale, N. Y., of injuries received when he was struck by an automobile earlier in the day. Mr. Johnson was fifty-nine years old. He was the author of books on mining and metallurgical subjects.

DR. MARY SOPHIE YOUNG, for the past eight years instructor in botany and curator of the herbarium in the University of Texas, died on March 5 after an illness of a few week's duration.

THE executive committee of the American Federation of Biological Societies has called the annual meeting for April 24, 25 and 26, 119, at Johns Hopkins Medical School, Baltimore, Md.

IT is announced that the German government has decided to return to China the astronomical instruments which were transported from Pekin to Germany in 1900. Negotiations have been opened for the shipping of the instruments to China.

UNIVERSITY AND EDUCATIONAL NEWS

THE legislature of Nebraska has recently appropriated for the College of Medicine at Omaha for the ensuing biennium a total of $380,000. This amount includes the maintenance of the University Hospital.

A GIFT of $5,000 for a scholarship in the Sheffield Scientific School of Yale University has been made by Mrs. Arthur A. Stilwell, of New York City, in memory of her son, Thomas Vincent Stilwell, who lost his life in the war.

FUNDS have been provided for a scholarship in the department of chemistry of the Univercity of Chicago, to be called "The Joseph Triner Scholarship in Chemistry." It is to be assigned to a Czecho-Slovak graduate of the Harrison Technical School, Chicago.

MR. EMIL MOND has offered to the University of Cambridge £20,000 to be used for the establishment of a chair of aeronautical engineering. The chair is to be designated the Francis Mond professorship of aeronautical engineering after Lieutenant Francis Mond, the son of the donor.

PROFESSOR EDWIN J. BARTLETT, senior professor at Dartmouth College and son of a former president of the college, has resigned from the chair of chemistry which he has held since 1883, his resignation to take effect in 1920. Leave of absence for the second semester has been granted to him.

IT is reported that Sir Arthur Newsholme, the distinguished British physician and author of works on the prevention of disease, has been offered the chair of public health at The Johns Hopkins University.

DISCUSSION AND CORRESPONDENCE

ON SOME PROBOSCIDEANS OF THE STATE OF NEW YORK

AT a meeting of the Geological Society of America in Washington, at the close of the year 1902,[1] the question arose as to the former presence of the mammoth in New York. It was said that, when Theodore Roosevelt, as

[1] SCIENCE, Vol. XVII., p. 297.

governor of New York, had urged that the mammoth should appear on its coat of arms, it was evident that, although a mighty hunter of existing game, he was a bit weak as regards extinct types. Sad to say, it was the members of the society that were a bit weak on this particular type. The following examples appear to vindicate the knowledge of the mighty hunter.

In 1842 J. E. De Kay[2] described a molar tooth of *Elephas primigenius* under the name *Elephas americanus.* It has been found at Pittsford, in Monroe County. In Rochester University there is a molar of the same species which is said to have been found at Williamson, Wayne County. Since the meeting referred to, Dr. Burnett Smith, of Syracuse University, has reported to the present writer a tusk and a tooth from Minoa, Onondaga County.

Of the great elephant known as *Elephas columbi,* a tooth was described from Homer, Cortland County, in 1847.[3] In the American Museum of Natural History, New York, there is a part of a molar which was found near Elmira, Chemung County, and which appears to belong to this species.

In 1843 Mather[4] stated that bones of both the mastodon and of the elephant had been found in Orange County. The identification of the elephant is doubtful. In 1858 Emmons[5] reported that an elephant tooth had been taken from the shore of Seneca lake. To which species this belonged is not known.

It would be interesting to learn when the mastodon (*Mammut americanum*) became extinct. It is certain that the species was widely spread over at least the northern states after the disappearance of the last glacial sheet. In New York they are found in great numbers in the southeast corner and at the western end of the state, in marls and mucks overlying the Wisconsin drift. Along lakes Erie and Ontario they are found on the lakeward side of the Iroquois beach, an indication that the species survived there until the waters had shrunken quite into their present limits.

Professor H. L. Fairchild[6] has recently shown that, while the foot of the Wisconsin glacier was occupying the northern side of Long Island, the sea occupied the remainder of the island: and that during this occupation a thick deposit of stratified drift was laid down. After the ice had retired from the island, probably well toward the north of the state, the region south of the ice sheet began to rise, and Long Island at length became dry land or swamp. In depressions on the surface of these sea-laid deposits, there afterwards accumulated silts and muck; and in these pond deposits at three or four places on the island, there have been found remains of mastodons. In one case at least, at Riverhead, the land had probably risen to nearly its present level, for the mastodon was found between present low and high water. This must have been well along towards the end of the pleistocene.

An interesting case is that of a mastodon found in 1866 at Cohoes, near the mouth of the Mohawk. This skeleton, nearly complete, was mounted by G. H. Gilbert and is yet in the State Museum at Albany. It formed the subject of an essay by James Hall[7] and also the first writing of Gilbert. At Cohoes there are found some hundreds of potholes, some in the bed of the present river, many of them in process of forming, others on the banks a hundred feet or more above the present river and long ago filled up. One of the latter, of irregular form, because of the coalescence of two or more originally distinct holes, proved to have a depth of more than 60 feet, and diameters of 33 and 73 feet. Out of this excavation had been taken thousands of loads of muck, with trunks and branches of decayed trees. At a depth of about 50 feet from the

[2] "Zool. N. Y. Mamm.," p. 101, pl. XXXII., fig. 2.

[3] *Amer. Jour. Agricult. and Sci.,* Vol. VI., p. 31, fig.

[4] Geol. 4th Distr., pp. 233, 636.

[5] Geol. Surv. N. C., East Counties, p. 200.

[6] *Bull. Geol. Soc. Amer.,* Vol. XXVIII., pp. 297–308.

[7] Twenty-first Ann. Rep. N. Y. State Cab., 1871, pp. 99–148, with plates.

original surface there was found the principal part of the skeleton, considerably scattered about, but with the skull nearly intact and with unbroken tusks. The bones lay on a bed of clay, broken slate, gravel and water-worn pebbles. This was probed to a depth of ten feet without finding bottom. The right fore leg of the skeleton was missing, but was later found in another pothole 60 feet farther up stream and at least 25 feet higher. Hall thought that the potholes were of glacial or preglacial origin, but I am assured by Professor Fairchild that they have been drilled since the Wisconsin ice sheet abandoned that vicinity. When the ice began to withdraw, the region was depressed about 350 feet below its present level, as a result of which the site of Cohoes was covered with a thick deposit of sand and clay. As the land slowly emerged, the old Mohawk River (Fairchild's Iromohawk) cut through the estuary deposits and finally reached the underlying Hudson slates. Then under the action of strong currents the drilling of the potholes began. The land had then risen, as Professor Fairchild writes, at least 150 feet. At the same time the stream bed was being worn down into the rock and the falls were moving up stream past the potholes. When the mastodon entered the pothole this had long before ceased being cut; for, as already stated, it had became filled to a depth of at least 10 feet with rock débris. It had quite certainly been abandoned by the river waters, except at times of flood. How now did the mastodon get into that hole? Hall concluded that it had been frozen up in the glacial ice and had been dropped part in one pothole, part in the other. But when those potholes were ready for occupation as a tomb for the mastodon, there was no part of the general glacial sheet from which the cadaver could have reached Cohoes. As a recently dead body it might indeed have been floated down the Mohawk; but the animal could as well have lived and died at Cohoes. We may fairly assume that it had only recently died and was lying on the flood plain not far above the potholes. No disarticulated bones could ever have been distributed as this skeleton was. The bones must, perhaps without exception, have been held together by the ligaments and probably much of the flesh remained. At this moment the river rose and swept the flood plain, carrying the cadaver over the potholes. First the right leg became detached and was swept into the upper one of the two holes; then the remainder of the body was carried on and dropped into the second hole. Here the swirling waters either at once or during subsequent floods scattered the skeleton somewhat. As time went on, all sorts of materials were borne into the potholes during freshets. Possibly some trees growing on their margins fell into them. At any rate, they finally became filled up.

It appears quite certain that when the Cohoes mastodon was buried the deposition of marine sediments in the Champlain and the upper St. Lawrence valleys had largely taken place and the Champlain epoch, about the last leaf of the last chapter of the Pleistocene, had nearly ended. Did mastodons end their career at this stage of geological history or did they continue on into the Recent epoch? It may be impossible to determine this. If they did continue to exist, it might be supposed that remains of them might be found in deposits of marl and muck overlying the Champlain deposits along Lake Champlain, and the St. Lawrence and Ottawa rivers; but the writer has not learned of any such cases. At any rate, the close of the Pleistocene or the beginning of the Recent became an insalubrious time for this species, a mighty race which can be traced back possibly to the Pliocene and which had weathered the vicissitudes of four or five glacial periods. At approximately the same time there perished two species of elephants, the giant beaver (*Castoroides*), the moose (*Cervalces*), and perhaps other great animals.

O. P. HAY

U. S. NATIONAL MUSEUM

HUMAN FLYING

TO THE EDITOR OF SCIENCE: While engaged in some scientific research, my attention was

called to an editorial article with the above caption, in the *American Journal of Mining,* April 25, 1868, Vol. V., p. 264, which later became the well-known *Engineering and Mining Journal.* A comparison of what is accomplished now with the scientific view of that day, a little over fifty years ago, may prove interesting to the readers of SCIENCE.

In part, the article states:

> Inventors have puzzled their minds for ages to compass the problem of air navigation by machines or by flying men; and but little advance has been made. . . . It would of course be absurd to affirm that anything could not be done, in this age of the world; but while this feat may be accomplished to an extent "enough to say so," we are incredulous of any practical benefit of the thing to man. . . . The force which a man is able to expend in rapid ascension of heights, even with the firm earth under his feet, is very small; and we have never seen any principle elucidated which was able by apparatus to increase his power or lessen his gravity in proportion to it.
>
> The balloon remains; but that, if used, presents such a surface to the atmosphere that it can not be accurately guided without, by means of steam-boilers or other weighty machinery, storing up power for propulsion, in a manner of itself too cumbrous and heavy for successful navigation.
>
> So that, whether it is for his own personal flight through the air or the management of a great atmospheric ship, man seems to be hemmed in on every side by almost insuperable natural difficulties. And besides, even were all this obviated, who would run the risk of accidents at a great height above the earth, beyond the reach of help—but not of gravitation? It is an interesting problem, and may result in pretty scientific toys; but for real helpfulness to humanity we see but little in Aeronautics.

Taking the vast change that has been worked out in the life time of many of us, does it not afford encouragement to our young people to endeavor to solve the many problems lying before them, ere the next fifty years shall pass?

M. E. WADSWORTH,
Dean Emeritus

SCHOOL OF MINES,
UNIVERSITY OF PITTSBURGH

KEEPING STEP

TO THE EDITOR OF SCIENCE: Sound travels about 1,060 feet per second at 0° C., or 265 feet in one fourth second. The soldier next the drummer steps with the drumbeat, the soldier 265 feet in the rear is one fourth second late and has his foot in the air when the foot of the front man is on the ground. This is because they march at 120 steps per minute (2 steps per second), which gives one half a step in one fourth second. Hence the soldier who hears the signal one fourth second late will fall one half step behind. I have seen this in columns turning into Victoria Street from Westminster Cathedral, at Lancaster Gate or Holloway Road, on Salisbury Plain, etc.

When tired out or on rough roads soldiers left to themselves do not keep step; but it is a remarkable fact that the only time they keep perfect step is when they are without sound signals. If the drum begins they lose perfect step at once and the feet are seen to strike the ground in receding waves as the sound passes down the line. If the drum stops, the men in two or three seconds get into perfect step again, and go with a sway and swing absent at other times. The French term it *rapport* or *esprit du corps.* Is there a mutual subconscious force passing between the men? In a short brochure of experiments in such matters to be found at public libraries I have suggested an explanation. Is it the right one? I should be glad to hear from American observers of the phenomena.

WALTER MOORE COLEMAN,
Fellow of the Physical Society of London
HARSTON, CAMBRIDGE, ENGLAND

QUOTATIONS

THE ORGANIZATION OF RESEARCH IN GREAT BRITAIN

IN a paper on the state organization of research, read at a recent meeting of the Royal Society of Arts, Sir Frank Heath, K.C.B., Secretary of the Department of Scientific and Industrial Research, succeeded in compressing into a few pages a lucid amount of the work of his department. His characterization of research in general is, so far as it goes, excellent, and ought to be taken to heart by the

public, but the treatment of a vast and complex subject which approves itself to one thoughtful man can not be expected to satisfy all his readers. If, then, we dwell upon points of disagreement, we are not the less conscious that Sir Frank's paper compares favorably with the lucubrations of most administrators.

In the earlier part of his paper he emphasized the novelty of the departure made by the government in 1915; and, without the assertion in so many words, rather implied that our government has handled the problem of national research with more courage and on more satisfactory lines than did that of the Germans. While we agree that the course followed here since 1915 was the best in the circumstances, we are emphatically of opinion that this is only true in consequence of past errors; that the idea inspiring the memorandum of v. Humboldt, quoted by Sir Frank Heath, is correct, and that the system of the German government was in principle thoroughly sound.

The German ruling caste appreciated the importance of scientific knowledge a century before ours, and conceived that the best way to foster research was to create a number of adequately equipped university departments; they believed that the multiplication of opportunities for disinterested investigation would lead to the production of trained minds capable, in Sir Frank Heath's words, "of extending the powers and capacities of man in relation to the world in which he lives." They had their reward; all that scientific ingenuity and foresight could do to safeguard the Teutonic hegemony was done there was no need of hasty improvisations. The German state system has perished in scenes of death and disaster, but of the many crimes and blunders committed by its makers, the neglect of science is not one. In this country, generations of neglect have compelled us to adopt in our hour of need an expedient which would not have found a single defender if proposed as a normal method of evolution. The courage of the government in 1915, which Sir Frank Heath extols, was the courage of despair; we could not then, we can not now, escape the penalty of a hundred years' sloth. It is too late to build from the ground on the German model, but we need not pretend that we have discovered for ourselves a better model, but should, with humble and contrite hearts, try gradually to improve our temporary structure into something like a real university system, keeping it free from such defects and abuses as in Germany that system revealed in practise; of these the worst was the prostitution of scientific appointments and scholarly reputations to the uses of political propaganda.
—*British Medical Journal.*

SCIENTIFIC BOOKS

Bastardierung als Ursache der Apogamie im Pflanzenreich. Eine Hypothese zur experimenteller Vererbungs- und Abstammungslehre. By Alfred Ernst, professor of botany in Zürich. Jena, Fischer. 1918. Pp. 650, with 172 figures and 2 plates.

The ultimate practical aim of the theory of mutation is avowedly to discover the means of producing new qualities in plants and animals at will and in arbitrarily chosen directions. Some investigators assume that one of the chief causes of mutation is to be looked for in crossing, whereas others think that crosses are far too rare in nature to have had any appreciable effect in the production of species, except for the polymorphous genera. Obviously the best way to decide between these two opinions is to study the influence of hybridizing on the origin of a new character. The author of this book has attacked this problem from a special side, proposing to try to induce a definite character, viz., apogamy, or the production of seeds and spores without fecundation, by means of artificial crosses. The book does not bring any new results, but a collection and discussion of the facts, available for the choice of the material and the method of experimentation to be used.

From this point of view it may be commended to the student of rich questions. It gives a full description of all known cases of apogamy, including algæ and fungi on one hand, *Marsilia, Antennaria, Alchemilla* and

Hieracium on the other. The doubling of chromosomes, the terminology of parthenogenesis, the nucellar embryos, the lessened fertility and many other effects of hybridizing, as well as those of vegetative propagation are extensively dealt with. From this survey the author concludes that *Chara crinita* seems to afford the best material for further studies and gives an ample review of the mode of propagation of this algæ.

It is a dioecious plant, which has a parthenogenetic variety. The latter has been described by *Alexander Braun* as early as 1856 and since by numerous authors. The species is rather rare; in some stations it is found without the variety but in the larger number of localities only the apogamous form occurs. In some, however, both grow together, indicating the possibility of a repeated origin of the variety from the dioecious type. Moreover it is shown that the differences between the two types are of such a kind, that they can not have originated slowly and gradually but must be assumed to be due to a sudden change (p. 104). This is the well-known way in which in other cases mutations are seen to arise. The probable difficulties of the intended investigation are then amply discussed. To these the reviewer might add the objection that it is a species which has already produced an apogamous form, and probably more than once and which therefore may be expected to repeat the mutation from time to time, even without the aid of experimental interference. Furthermore, the experience with the evening primrose has shown that mutations occur in crossed progeny as well as in pure lines and the research of Baur on *Antirhinum* and of Morgan on *Drosophila* have amply confirmed this result. Among hybrid progenies they seem to be more numerous, but only in consequence of the fact that such cultures usually embrace many thousands of individuals more than are kept in the pure stocks. The same will be the case in the cultures of *chara crinita* and the expected occurrence of apogamous mutations in hybrid families can, therefore, not be regarded as a proof of their origin by means of hybridization.

But it seems highly desirable that the experimental trials should be made, the more while in any case the gain for the theory of mutation must be expected to be of the highest importance.

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PRELIMINARY REPORT OF EXPERIMENTS ON THE ACTION OF DICHLOROETHYLSULFIDE (MUSTARD GAS) ON THE CELLS OF MARINE ORGANISMS[1]

THE toxic action of a sample of "mustard gas" sent us by Major H. C. Bradley, of the Chemical Warfare Service, has been investigated on a number of typical marine organisms, including various swimming larvæ (sea-urchin, starfish, squid, the annelids *Nereis* and *Arenicola*), the developing eggs of sea-urchin and star-fish, the spermatozoa of sea-urchin and starfish, and young and adult fish (*Fundulus*). The most satisfactory objects for experimentation have proved to be the developing eggs of the starfish (*Asterias forbesii*), and most of our work has been carried out with this material. Changes in the rate and character of cleavage in the eggs after treatment with "mustard," the production of abnormalities of form and structure in the larvæ, and the degree of ciliary activity, furnish a very delicate index of toxic action. Valuable information has also been obtained with *Arenicola* larvæ and with small fish (*Fundulus*).

In the experiments with fertilized starfish eggs we have investigated the influence of solutions of the "mustard gas" in sea-water upon the cleavage and early development (up to the gastrula stage). The procedure chiefly employed was as follows: A small quantity of the "mustard gas" (ca. 5 grams) was shaken vigorously with one liter of sea-water in a

[1] This preliminary report in its present form was sent to the Medical Section, Chemical Warfare Service, September, 1918. A more detailed account of these experiments will be published in the near future.

2-liter glass-stoppered bottle. After the finely divided undissolved oil had settled, the clear liquid from the middle of the solution was drawn off, and the action of this saturated solution upon the recently fertilized mature eggs was tested, using varying dilutions (*e. g.*, 1/2, 1/4, 1/8, 1/16 saturated) and varying times of exposure (from one fourth minute to an hour or more). The eggs were exposed to the solutions in glass-stoppered bottles, and at intervals portions were transferred by pipette to dishes of normal sea-water; this water was changed when the eggs had settled. The subsequent course of cleavage and development, as compared with that of untreated "control" eggs, was carefully studied.

The toxicity of "mustard" solutions prepared in the above manner is not constant but decreases with standing, and the more rapidly the higher the temperature. Solutions made at room temperature (20–24°) always prove strongly toxic if used immediately after preparation; if used later the toxic action is less marked, the decline of toxicity being rapid in the first hour and more gradual later. This decline is due to the progressive hydrolysis of the "mustard," which breaks down rapidly in aqueous solution, yielding HCl and residual compounds of low toxicity. The toxicity of a "mustard" solution two days old, in which the acid freed is neutralized by NaOH, is not more than one fiftieth of that of the freshly prepared solution, as measured by the comparative times of exposure required to produce a definite impairment of development or a definite proportion of dead eggs in a given time. The attenuation of toxicity, as thus shown by the physiological action of the solution, exhibits a general parallelism with the production of HCl, as measured by titration (with dibromocresolsulphonephthalein as indicator). The essential toxic action is thus due to the undecomposed "mustard" in the solution. This conclusion was confirmed by experiments in which the hydrolysis of the compound was retarded by cold. The oil was shaken with ice cold sea-water (below 3°), the solution was filtered free from the residual undissolved crystals of "mustard" (which is solid at this temperature), and the cold saturated solution thus obtained was kept at 0° (surrounded by ice in the refrigerator). The toxic action of a portion of the solution kept thus cold and brought to room temperature immediately before adding the eggs was compared with that of portions which were brought to room temperature and allowed to stand for varying times (*e. g.*, 1/4 hour, 1/2 hour, 3 hours, 24 hours) before using. In all cases solutions which were kept cold until just before using were decidedly the most toxic, 15 minutes' exposure to room temperature reduces toxicity by about one half, and 30 minutes by two thirds or three quarters. The decline in toxicity is thus at first rapid, then more gradual; the same is true of the production of acid as shown by titration. The reaction is apparently mono-molecular.

Our experiments favor the following conception of the mode of action of "mustard" upon the living cell. The undecomposed "mustard gas" is slightly soluble in water (according to our titrations of completely hydrolyzed solution to the extent of ca. .05 per cent.). This dissolved "mustard" readily penetrates the cell, presumably because of its high lipoid-water partition-coefficient, and collects in relatively high concentration in the organic solvents of the protoplasm (cell-lipoids, fats, etc.). In this situation it serves as a reservoir of toxic material which continually enters solution in the aqueous phases of the protoplasm and is continually being there decomposed. Since by its hydrolytic decomposition it yields acid, the dissolved "mustard" acts destructively on the protoplasm as soon as the available buffer compounds (which normally prevent protoplasmic hyper-acidity) are exhausted. The destructive action is thus due primarily to the HCl freed by hydrolysis. The other decomposition-products are only slightly toxic; this we have shown experimentally by comparing the action of partially or wholly hydrolyzed solutions of the "mustard," from which the acid was removed by neutralization with NaOH, with that of the unneutralized solution. The latter solution is always by far the more toxic;

removal of the acid thus removes the greater part of the toxicity. The continued intracellular production of acid from the reserve of lipoid-bound "mustard" renders the compound, once it has penetrated the cell, extremely persistent in its action and difficult to counteract.

The toxic action of "mustard gas" has a prolonged latency, a fact in accordance with the above conception. Fertilized starfish eggs treated for a few minutes (up to eight minutes) with a freshly prepared weak solution of "mustard" continue to cleave for some hours, at first regularly; later the cleavage becomes irregular and the eggs break down and disintegrate. If acid derived from the progressive hydrolysis of "mustard" contained as reserve in the cell-lipoids is chiefly responsible for the toxic effect, the long latent period of action is readily understood. An experiment with adult fish (*Fundulus*) illustrates both the long latent period and the necessity that the "mustard" should be absorbed by the living cells while it is still in the intact or non-hydrolyzed state. Four fish were placed in each of the following solutions: (A) Filtered solution of "mustard" kept at room temperature five days; (B) a similar solution kept at room temperature one day; (C) the same solution as B, but kept at 0° C. and brought to 20° C. one half hour before using; (D) the same solution kept at 0° C. until immediately before using.

Solutions A and B were almost non-toxic; three of the four fish remained alive after five days in the solution; in C all fish were living after three hours, three were dead in eighteen hours, and all in twenty-six hours; in D two were dead and a third dying within three hours. The toxicity is thus an inverse function of the time during which the "mustard" is undergoing hydrolysis.

While the loss of toxicity of an aqueous "mustard" solution corresponds roughly with the decomposition of "mustard" as determined by titration, a lag in loss of toxicity at the end of the curve suggests that in those extremely dilute solutions the organism takes up a larger proportion of the poison than would be anticipated, possibly as a result of adsorption.

The velocity of the toxic action exhibits a high temperature-coefficient similar to that of chemical reactions in general. In one experiment freshly fertilized starfish eggs were placed in two portions of the same "mustard" solution, one (A) kept at 9 to 10°, the other (B) at 21°. From each solution eggs were transferred to normal sea-water after exposures of 1, 2, 4 and 8 minutes. It was found that an exposure of 2–4 minutes at 21° had almost the same effect in preventing development as one of 8 minutes at 9°–10°. All eggs were killed by 8 minutes' exposure at 21°, while most survived this exposure at 9°. The rate of toxic action at 9°–10° is thus about one third of that at 21°. This result suggests that *cold*, in conjunction with the other methods of treatment, may prove to be of service in treating the skin-burns caused by "mustard gas," *i. e.*, it indicates that the temperature of the skin should be kept as low as possible during the treatment (*e. g.*, washing with ice-cold kerosene is suggested).

Experiments on the counteraction of the toxic action by subsequent treatment with weak basic substances which readily penetrate protoplasm (ammonia, aniline) have not yielded very conclusive results. In several experiments fertilized eggs exposed to "mustard" solutions for some minutes and then brought for three or four hours into sea-water containing a little ammonia $n/2000$ (NH_3 in sea-water) showed on the whole a more favorable development than eggs returned directly from the "mustard" solution to sea-water (*i. e.*, larvæ showed less irregularity and more active ciliary movement). This favorable effect of ammonia was distinct but somewhat slight. In other experiments *Arenicola* larvæ treated for some minutes with solutions of aniline in sea-water (of the anæsthetizing concentration, ca. 1/8 saturated), and then exposed to "mustard" solution, proved distinctly more resistant to its toxic action than the control. This effect is probably to be regarded as an example of the general protective or antitoxic action which anæsthetics exhibit

with this organism. It is possible, however, that the basicity of aniline may be favorable; larvæ anæsthetized with alcohols showed some degree of protection, but less marked than with aniline. The after-treatment of poisoned larvæ with aniline solutions proved ineffective.

Treatment with basic substances appears to us to offer the most promising means of counteracting the action of this poison. A substance whose physical properties, solubilities, and rate of hydrolysis resemble those of "mustard," but which yields on hydrolysis a *base, e. g.,* ammonia, instead of an acid, ought theoretically to counteract the action of "mustard" within the cell. Such a compound could be introduced into the lungs in the form of a spray, or applied to the skin in the usual manner. High lipoid-solubility or surface-activity, favoring rapid penetration of cells, would be essential in such a substance. We recommend a systematic search for an organic compound having these properties. Physiological experimentation with such a compound, if it is obtainable, should in our opinion yield important results.

By the use of intravitam staining, and by the injection of aqueous "mustard" solution directly into the body of the starfish egg, strong evidence was afforded that free acid is liberated within the cell.

The intravitam stain used was neutral red. Eggs were treated with solutions of "mustard" oil (in sea-water) sufficiently concentrated to cause subsequent abnormal development, and were then transferred to an extremely dilute solution of neutral red in sea-water. Normal eggs were simultaneously treated with the neutral red solution. For a period of at least half an hour controlled and treated eggs were colored to about the same degree. The treated eggs later became progressively more intensely stained, so that in an hour after the treatment the greater intensity in color of the "gassed" eggs over that of the control was easily recognizable.

The effect of "mustard" and its decomposition-products on the cell-interior was tested by the introduction of a drop of the gas solution into the body of the fertilized egg by means of a micro-pipette. The following results were obtained:

1. Eggs injected with distilled water quickly recover and continue their normal development.

2. Eggs injected with a freshly made saturated aqueous solution of "mustard gas" show no immediate injurious effects but subsequently are inhibited in their development.

3. Eggs injected with a saturated solution which has been allowed to stand at room temperature for over two hours undergo cytolysis, the immediate destructive effect being more marked than that following the injection of the undecomposed solution.

4. Eggs injected with an aqueous solution of hydrochloric acid of the same strength as the decomposed gas solution exhibit approximately the same effect, viz., a more or less extended cytolysis.

These experiments lend substantial support to the view, previously expressed by Marshall and Smith, that mustard gas, in virtue of its lipoid-solubility, penetrates rapidly into the cell-interior where it liberates hydrochloric acid which, in the free state, is relatively incapable of penetrating the cell.

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SPECIAL ARTICLES

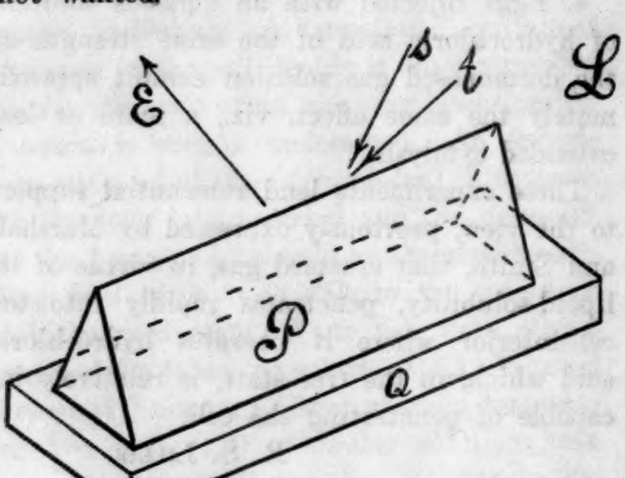
ON HERSCHELL'S FRINGES

Herschell's fringes, as produced by the familiar apparatus consisting of a right-angled prism reposing with its broad face on a plate of obsidian, present the well-known group of achromatic fringes running parallel to the arc or limit of total reflection. Observation is made in a direction normal to the edge of the prism.

It occurred to me that the phenomenon could be made much more striking and of wider scope, if a long 60° prism were used and observation made in a plane of symmetry *parallel* to the edge of the prism. In the interest of variety, moreover, it is preferable not to em-

ploy strictly accurate surfaces; so that the prisms with which grandfather used to decorate his gas fixtures will, as a rule, suffice admirably. In the figure P is such a prism (truncated) on a plate of obsidian Q, the long edges being normal to a white window curtain at L near by, illuminated with sun light or day light; or any light toward the front, overhead, is good.

The rays that are wanted, s, will enter symmetrically at a mean angle of about 30° to the vertical and after reflection at the base of the prism and the plate, reach the eye in the direction$E$. The rays totally reflected, t, come from a greater angle to the vertical and are not wanted.



The limit of total reflection here (also easily recognized) is usually a sharp parabolic or cuspidal apex. The light seen through either face enters by the opposed face. On looking down from a steeper angle and with properly selected faces, brilliant groups of complete confocal ellipses (major axis one half to over two inches), of confocal hyperbolae may be seen in each of the roof faces. To find advantageous combinations, the three faces of each prism should be examined in succession, and it is well to rub P on Q to improve the contact. On moving the eye fore and aft or using different pressures, any type of ellipse with white or colored disc may be produced at pleasure. It is usually preferable to use a shorter plate Q than is given in the figure, about one half the length of the prism.

When well produced the ellipses may also be seen by side light, with different patterns in the two roof-faces.

The type of interference figure clearly depends on micrometric differences of the faces in contact. The ellipses are Newton's rings modified by the color dispersion of the glass. The hyperbolae, however, are about equally frequent; but their character is less easily stated. They probably originate in cylindrics. The case of the 45°–90° prism, with the right angled faces respectively horizontal (on the plate) and vertical, is also interesting; for here the ellipses are apt to be *circles* with each of the two groups seen after two reflections, one in each of the orthogonal faces. The light should enter nearly normal to the oblique face. As it leaves in the same way, one should observe through a horizontal slot in a white screen.

I may add a similar observation: If a cylindrical lens (say 1 diopter) is placed on a plate and illuminated with homogeneous light, the interference pattern consists of a succession of equidistant arrow heads along the line of contact, all pointing in its direction. Now these are the very forms observed in the interferences of reversed spectra along the line of coincidence of spectra, except that the latter are apt to be far narrower than the former. It seems therefore, as if the effect of color variation in one case and of the cylindric increase of thickness of air film, in the other, were formally capable of like treatment.

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